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ABSTRACT

Examined were the home verbal environments of three multiply handicapped language impaired children (3, 6, and 8 years old). Each child wore an FM transmitter-microphone for 3 1/2 consecutive days. Priliminary analysis of the accustic data was in terms of actual data time, parental lesson time, and number of engaged (verbal interactions) and unengaged times in the natural environment. Descriptive analysis was then performed along four dimensions: an overview of the household, the vocal controls directed to the child, the vocal movements displayed by the child, and the non-vocal movements displayed by the child which were the setting for engagements. Two major conclusions were that each child spent the major portion of the day unengaged thus limiting the opportunities for the establishment of verbal behavior; and that the nature and functions of the engagements which did take place were unlikely to enhance the establishment of verbal behavior. The results underscored the need for parent education programs. (DB)

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INTRODUCTION

Few present day theorists and researchers would dispute that environment affects what we will for the moment call "the acquisition of language." The nature and extent of its role, however, is an issue which has been a matter of great contention. The theoretical viewpoints of the fifties and sixties reflected clear-cut divisions among theoretical approaches. Of late, the trend has been towards more cross-talk, the development of integrated theoretical positions, and the design of language intervention programs for verbally-impaired children.

The recent shift in emphasis in the treatment of the handicapped from institutionalization to out-patient care and a growing awareness of over three and a half million verbally handicapped children (Marge, 1972) has prompted research to focus its efforts in two areas -- namely, those environmental factors which facilitate "normal" language development, and those which may alter its "normal" course. One of the areas which has been thoroughly examined has been the functional relationship between early vocalizations and social contingencies of reinforcement. The studies of Siegel (1969), Todd and Palmer (1968), and Routh (1969) indicated that the vocalizations of children as young as three months could be controlled by social contingencies. The Todd and Palmer study also explored the nature of those contingencies. The smiling face of an adult in combination with vocal praise was found to be more

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*The research reported here took place at the Verbal Behavior Laboratory of the University of Rochester.

effective in increasing the frequency of a child's vocal movements than the exclusive appearance of vocal priase, and the exclusive appearance of vocal praise was found to be more effective than the absence of all social consequences. The Routh study was successful at differentially strengthening consonant and vowels sounds.

Imitation has also been studied very extensively. While it is generally thought to be an important procedure in teaching language, its role in the development of language in the natural environment is not as clear-cut (Bricker and Bricker, 1974; Graham, 1976).

A naturalistic study by Bateson (1975) analyzed videotapes of mother-infant interactions for the earliest appearance of "conversation-like alternations." The results indicated that social interactions between infants and mothers resembling conversations appeared prior to the third month. Bateson concluded the report of her investigation with the identification of the need for more detailed analyses of mother-child interactions in early infancy. In addition to detailed analyses of the mother's vocalizations, she called for a more careful examination of the acoustic properties of the vocalizations of both mother and child in relation to context.

Much of the research with verbally-deficient children has documented that adults display vocal behaviors depending upon the child's "verbal level" (Siegel, 1967). In a study reported by Siegel (cited in Siegel, 1967), children with lower type-token ratios were found to control greater vocal output on the part of adults. However, the specific nature of these interactions were shorter and more redundant than those of the children who had higher type-token ratios.

Ryan (1975) reports a comparison study between "subnormal" children and "normal" children in which it was found that single word vocabulary recognition and naming were equal or better in the population labelled "subnormal" (primarily Down's syndrome children). In addition to suggesting that these results might be a function of the "subnormal" children's slower development and greater chronological age, she proposed that they may be a function of how adults talk to them. In a discussion which concluded the article, Ryan raised several issues regarding the development of "subnormal" children and the aspects of environment which might be relevant. She questioned whether the usual pattern of parental expectations and behavior were disrupted by the presence of a "subnormal" child in the family, and she suggested that perhaps mothers of unresponsive children do not carry on active dialogues with their children in the same way as they would with "normal" children.

Recently, innovative language training programs have been designed to teach parents of developmentally disabled, at risk, or verbally-handicapped children to be effective language teachers (Bricker and Bricker, 1974; MacDonald, et al., 1974; Guess, Sailor, and Baer, 1974; Miller and Yoder, 1974). By putting aside inconsequential theoretical issues and drawing on the strengths of a variety of theoretical approaches, they have been successful not only in changing the nature of parental interactions with their handicapped children, but also in establishing functionally effective verbal skills and their identified antecedents in the children.

However, what is lacking as a resource for language intervention programs and in the study of parental interactions and their relationship to "language acquisition," is a thorough description of the home environments of those children who are described as verbally-handicapped. Research directed to this end would not only aid in the development of more effective language programs, but would also begin to answer some of the questions raised in the literature. Naturalistic research has long been recognized as a neglected area of research; the methodological difficulties in obtaining bonafide naturalistic samples has been a major stumbling block.

Willems and Rauch (1969) wisely point out, "Naturalism is a matter of degree." It is the opinion of this investigator that completely natural data from home environments is ethically unobtainable, but significant strides can be made in the direction of acquiring naturalistic data by the careful design and execution of ones methodology.

The purpose of this investigation was to describe the relationship between home verbal environments and the behavioral repertoires of non-talking children. More specifically, the research to be described here is directed to:

1. the design of a methodology for obtaining large, uninterrupted segments of naturalistic data from the home environments, and the development of a descriptive framework from which to deal with it, and
2. the investigation of the nature of the interactions between parents and their verbally-handicapped children and the

implications which these have for the establishment of verbal behavior.

In this investigation, the home environment was viewed, not as the place where a child "acquires language," but rather as the place where verbal behavior is established. This obliged the investigator to look carefully at parents as the principal managers and teachers in that environment, since they are the ones who establish and strengthen the behaviors which their children come to display in the home setting and which ultimately come to be displayed in many other environments. The concern of this research was not to answer why it was that these children have not come to talk, but rather to identify and describe aspects of their environments which might be arranged and managed differently so as to increase the probabilities of the establishment of verbal behavior.

THEORETICAL BASE

The Descriptive Analysis of Behavior, the name given by S.M. Sapon to the behavioral theory he has developed over the past decade, is the theoretical foundation upon which this project was based. Although the Descriptive Analysis of Behavior acknowledges the same Skinnerian origins as the Experimental Analysis of Behavior, it deviates from that discipline with reference to certain theoretical, methodological and ethical principles (Sapon and Kaczmarek, 1975). In the next few pages, this author hopes to provide the reader with sufficient background in the theory to make the remainder of the paper meaningful. The reader is urged to consult the references at the end of this paper for a more complete treatment of the theory.

Basic to the Descriptive Analysis of Behavior is the Principle for the Description of Behavior (Sapon, 1972, 1976):

> In some environment (SETTING)
> a movement is displayed, which is followed by
> changes in the environment (SUBSEQUENCE).

The statement pinpoints what it is that the descriptive analyst is interested in observing, namely

The environment immediately antecedent to a set of movements	What it is that an organism is observed to do	The environment immediately following the set of movements
or	or	or
SETTING	MOVEMENT	SUBSEQUENCE

Within this framework, written descriptions of each of the three terms (Setting, Movements, and Subsequence) are recorded. This is called a Line of Behavior, a Line of Analysis, or a Three-Term Description.

Since behavior is actually a continuous display of movements in continually changing environments, the environment subsequent to one movement becomes the setting for the next. In this way, a series of movements can be described as a "chain" of single Lines of description. For example, the following is an analysis, or a three-term description of self-feeding:

SETTING	MOVEMENT	SUBSEQUENCE
Man sitting at a table in front of a plate of food; fork on the table near plate	Man picks up the fork	Man with fork in hand
Man with fork in hand	Man spears carrot slice onto fork from plate	Man holding in hand a fork with a carrot slice on it
Man holding in hand a fork with a carrot slice on it	Man moves fork with carrot towards his mouth	carrot slice in mouth; fork empty
Carrot slice in mouth; fork empty	Man returns fork to table	fork on table; man emptied-handed

Note that in the above analysis, the Subsequence to one set of movements becomes the Setting for the next set of movements. The three-term analytical framework presented here is used not only to describe observed events, but is also the basis for writing pedagogical objectives

and designing strategies for the establishment of specified objectives.

Sapon has formulated a set of predictive statements describing the relationships between the three terms of a Line of Behavior. He calls these the Three Laws of Behavior (1972, 1976). In summary (and at the risk of gross oversimplification), these laws indicate that the Setting and Subsequence of a set of movements control its probabilities of occurrence, and that the strength of a behavior is related to the number of times it has been displayed.

Unlike Behavior Modification, the Descriptive Analysis of Behavior does not operationally define classes of behavior. Description, rather than frequency, represents the primary basis for predicting and changing behavior.

Verbal Behavior, as defined by Sapon, is similar to all other behavior in that it is occasioned by Settings and followed by Subsequences, both of which control (change) the probabilities of the display of movements (1973). Verbal behavior, however, is distinct in that it is characterized by a special relationship between two Lines of Behavior. Generally speaking, when this relationship is observed, each Line is displayed by a different individual. This makes it possible to define this relationship as the interaction of the behavior of two people in which the behavior of one person controls, in a specifiable and predictable way, the behavior of another. For example, if Person A says to Person B, "Please close the door," and Person B stands up, walks over to the door and closes it, an episode of verbal behavior has occurred. When this description includes other properties of the setting in addition to what the people say and do, Sapon (1973)

refers to this as a "verbal episode." In his elaboration of the theoretical principles, Sapon (1973) proposes a six term framework for describing verbal episodes. A discussion of this analytical format is beyond the scope of this paper; however, it is important to note that it is only after two people have shared a common behavioral history or else have experienced similar behavioral histories with regard to certain properties of the environment that a verbal episode can take place.

Sapon (1965) distinguishes between the behaviors of a verbal episode which control and which are controlled. The former he calls "productive verbal behavior" or "verbally controlling behavior;" the latter he refers to as "receptive verbal behavior" or"verbally-controlled behavior." In the example above, Person A is seen as displaying productive verbal behavior by requesting that the door be closed; Person B has displayed receptive verbal behavior by closing the door.

This study is concerned with one specific type of receptive and productive repertoire and its establishment. The productive repertoire consists of articulatory movements which change the acoustic properties of the environment; the receptive repertoire is distinguished by the fact that it is under the control of those acoustic properties. These repertoires are identified as the productive-acoustic and receptive-acoustic repertoires. It is important to describe in general terms how these repertoires are shaped by the verbal environment.

A child's receptive-acoustic repertoire is established as specific movements of the child are strengthened in settings which include the articulatory movements of the parents. As the history between the parents and the child becomes more extensive, the acoustic properties of the setting, i.e., the Subsequences to the articulatory movements of the parents, acquire more specific control over the movements of the child. Early in a child's history, he comes to display movements, generally gross body movements, appropriate to relatively simple properties of the Setting, e.g., "Go to daddy."; "Wave bye-bye."; "Give me the ball." when the ball is the only object in the setting. Many of these settings also include models for the movements to be displayed. Later, as the child's history with regard to the vocal properties of the environment becomes more extensive, he comes under the control of more complex vocal and physical properties of the setting, e.g., "Go over to daddy and give him a kiss,"; "Give me the red ball" when there are other colored balls in the setting. The child is said to "come under verbal control," that is, display a receptive-acoustic repertoire, when there are an extensive number of settings in which the parent's articulatory movements very predictably and specifiably control the child's movements. As more members of the verbal community at large come to interact with the child, the child's receptive-acoustic repertoire is expanded.

Similarly, the child's productive-acoustic repertoire is established as the vocal movements of the child come to control more specific and greater chains of parental movements in specific settings. From birth, the vocal movements of the child are shaped, refined and

strengthened as they function to control the movements of the parents. For example, a particular vocalization on the part of a child may control many different behaviors on the part of the parents depending upon the setting in which it is displayed (Sapon,1959). When displayed in the kitchen, "eeee" for instance, may be the occasion for mother to give the child a cookie, while the same vocalization displayed in the context of play may be the occasion for her to play patty-cake with the child. As the child's articulatory movements come to resemble those of the other members of the verbal community, more specific control is exercised by the display of the child's vocal movements. When the child displays articulatory movements which function specifiably and predictably to control the movements of many members of the verbal community in many settings, we say that the child displays "verbal function."

In the establishment of verbal behavior, the relationships between the terms of lines of behavior must be viewed bidirectionally. In other words, the probabilities of the movements of both people are changed as a consequence of the interaction between the two. For example, the mother who extends her hands and says to her child, "Give me the ball" may increase (or decrease) the probabilities of the child handing his mother the ball. Similarly, whatever movements the child displays in this setting also changes the probabilities of the movements which mother displays in the setting of the child holding the ball. The actual direction of the change in probabilities, whether probabilities of movements are increased or decreased, depends upon the behavioral histories of both people with regard to the general

properties of the setting. The movements to be displayed by either party in this setting can only be predicted by an outside observer if sufficient data regarding their histories have been previously available.

Our brief analysis of how receptive and productive acoustic verbal repertoires are established makes clear that the establishment of verbal behavior rests specifically on shared behavioral histories in common environments, thus requiring the moving or engaging presence of another person. If we focus on these concerns, a new unit of analysis needs to be defined. This unit of analysis has been called an engagement, that is, participation in the environment of another person by displaying movements relative to the body and/or behavior of that person.

Within the context of this investigation, engagements are taken as the behaviors of other people which form part of the Settings and Subsequences to the movements of the non-talking children under study. A unit of engagement refers to the behavior of a particular person, representing an element of either the Setting or the Subsequence to a given set of the child's movements. Any given unit functions as a part of the subsequence to one set of movements and as a property of the setting for the next set of movements. As part of the antecedent and subsequent environments, engagements can be viewed as elements which exercise varying degrees of control over the probabilities of the display of movements. If the control exercised is specifiable and predictable, then we can say that a verbal episode has occurred. Other pertinent details relative to this formulation and the Descriptive Analysis of Behavior will be discussed later.

SUBJECT POPULATION

Although the three severely, multiply handicapped children who were the subjects of this study possessed varied diagnostic and behavioral histories, they had in common the fact that they were all severely language impaired. At the time of the study, all three children and their parents were enrolled in the Verbal Behavior Laboratory's Verbal Habilitation Program which was under the direction of Stanley M. Sapon (1973). This special educational program deals primarily with multiply handicapped children manifesting a wide range of verbal deficits. A primary concern of the program is the establishment of professional-level repertoires of analysis and teaching in a child's parents, so that both mother and father could provide their handicapped son or daughter with carefully-planned, individualized educational activities throughout the day. The teaching activities in the home were supplemented by sessions conducted by staff members in the Laboratory setting. As parents became more competent teachers, laboratory sessions were gradually reduced from daily to twice weekly. The data for this study was collected early in the first phase of the Program when parent instruction and intervention were limited to teaching activities in a specially designed one-to-one environment, called a RABbit Room (Sapon, 1973), which had been set up in a secluded room in each of the homes.

Three-year-old Carrie was the youngest of the three children in the study. Her birth, following a full-term pregnancy, was unexceptional. Six months prior to her enrollment in the Verbal Habilitation Program, her parents sought an extensive diagnostic

evaluation at a local agency. The initial interview with the social worker revealed that although her parents had been "aware of their daughter's delays for the past year," they had "followed the advice of the pediatrician to be patient and to see what Carrie would do on her own." When the interviewer remarked that there appeared to be very few toys and playthings about the house, Carrie's parents explained that their daughter had "little interest in toys and ignored any that were presented to her." Thus, "all the toys were kept upstairs in her room." (Incidently, although Carrie began to walk independently at seventeen months, she did not climb stairs at the time of the interview.)

The subsequent evaluations by the psychologist and occupational therapist concurred in their description of Carrie as an "unresponsive," "severely delayed" youngster with "possible sensory deficits in vision and hearing, and/or emotional problems." In addition to confirming the impressions of these two disciplines, the speech and hearing report concluded more definitely by saying that Carrie is "emotionally disturbed" and "as a result is functioning as a severely retarded youngster."

Clifford was six years old at the time of the study. His records reveal that his birth was uncomplicated following a full term pregnancy. Shortly after his first birthday, Clifford was referred for audiological testing which resulted in a diagnosis of normal hearing in one ear and severe impairment in the other. Subsequently, he was enrolled in a joint home demonstration and speech therapy program for the hearing impaired. During the course of his two and a half year

attendance in this program, periodic audiological testing proved "highly inconsistent," and ranged from "little or no residual hearing" to "normal." At four years of age, his hearing was determined to be in the "profound loss range," and he was enrolled in a pre-school program for the deaf.

Shortly before his fifth birthday, Clifford began having seizure difficulties. Seizure activity has persisted since that time with varying degrees of intensity. Since these problems first arose, the dosages and types of medications have been regulated and changed accordingly.

Clifford's referral to the Verbal Habilitation Program was precipitated by his misbehavior in the pre-school setting; he was reported to "frequently test limits," "ignore discipline and correction," and be "disruptive in group situations by hitting others, butting people with his rear, grabbing objects removed from his reach, running around the room, and pushing a chair around the room."

Marty, who was eight years old when the study was conducted, was the oldest of the three children whose verbal environments were investigated. Marty was diagnosed as having "mild global retardation" and as"suffering from a severe communication disorder with associated behavior problems of an autistic nature." His speech was described as "echolalic;" several other behavioral repertoires which he displayed were characterized by one professional as "self-stimulating, ritualistic and bizarre." It was after Marty had been followed by a pediatric neurologist, tried on several psychoactive drugs, and enrolled in various educational and therapeutic programs that he was brought to

the attention of Dr. Sapon and the staff of the Verbal Behavior Laboratory. Several months before his referral, he had also begun to stutter.

At the time of his enrollment in the program, Marty was attending a special education class for the "trainable mentally retarded." After one semester, his teacher described him as "generally unaware of classroom routine" and as "requiring constant attention."

METHOD

An FM transmitter-microphone was sewn into a smock and worn by each child at home from the time of awakening until bedtime. The microphone transmitted family-child interactions and other acoustic data to an FM receiver and reel-to-reel tape recorder. The recording apparatus was operative in each household for three and a half consecutive days, yielding a total of 72 hours of acoustic data from the three households investigated.

Before the equipment was installed, parents were informed that the recordings were needed to gather data on the specific articulatory movements which their child displayed as well as the settings in which these movements occurred. It was explained that this information would be used for the formulation of programs in the natural environment at some future date. Permission to initiate the recording was requested; all of the parents agreed to the procedure.

The descriptive emphasis of the study called for a method of accurately and precisely converting the acoustic data into more tangible graphic form. Careful consideration was given to a method which would be precise as well as economical of time. The method selected involved dictating onto an audio cassette recorder what was heard on the tape as it was being played back. This included exact dictation of all vocal interactions between engagers and the child, all vocal exchanges about the child among other people in the household, all vocal movements displayed by the child as well as the specification of acoustic events relating to non-vocal movements. Although background conversation was noted when audible, it was not dictated unless the content

was considered relevant, e.g., discussions about the child.

Since most of the available acoustic data were related to what people said (rather than non-vocal movements which people displayed), a pause of about five seconds or more in a chain of such movements was considered the marker between "units" of engagement. The investigator, while dictating, tagged these units by turning off the microphone, thus leaving an acoustic signal on the cassette recording. Each of the cassettes was then transcribed so that units of engagement were clearly identifiable. Any set of movements displayed by the child, whether acoustically observable or indirectly derivable from the vocal movements of the speaker (e.g., "Don't hit me."; "What a big smile!"), also marked the boundaries between engagements. Thus, the "stream of behavior" was divided functionally, representing a level of detail consistent with the available acoustic data. Arranged in this fashion, the data could then be easily analyzed according to Sapon's three term descriptive framework. Predictable relationships between antecedent environmental events and a child's movements, between the child's movements and subsequent environmental events, and between sequences and patterns of lines of behavior were made clearly visible by these procedures.

In addition to dictating, the listener controlled four clocktimers from which data were directly obtained or calculated. A measure of recording efficiency for each day's recording was calculated. Periods of interference (caused by some electrical appliances and/or radio stations broadcasting on near-by frequencies) were timed and subtracted

from the total time in which the apparatus was in operation. This yielded the total time of clearly audible recording, and will be referred to as the Actual Data Time. The recording efficiency was then calculated as the percentage of Actual Data Time to total recording time (see Table 1).

The duration of each parental teaching lesson in the special one-to-one teaching environment was also measured. Since these sessions could not be considered as events of the natural environment, the times were not included in either engaged or unengaged totals.

Added together, engaged, unengaged, and parental lesson times yielded the Actual Data Time; Actual Data Time minus parental lesson times yielded time spent in the natural environment. The percentages of engaged and unengaged times spent in the natural environment were then calculated.

Child	Min. "on"	Min. Interf.	Actual Data Time (Min.)	Recording Efficiency
Clifford	1652	854	798	48.3%
Carrie	932	116	816	87.5%
Marty	1728	378	1350	78.1%

Table 1. Distribution of factors relating to recording efficiency in each household.

THE DESCRIPTIVE ANALYSIS

After the tapes were transcribed, the transcriptions became the basis for a descriptive analysis of the households. The analysis was directed along four dimensions -- an overview of the household, the vocal controls directed to the child, the vocal movements displayed by the child, and the non-vocal movements displayed by the child which were the setting for engagements.

The overview description of the household included the following factors:

a. total engaged and unengaged periods of time;

b. a breakdown of the distribution of engagements across engagers;

c. the amount of time that the television, radio and/or stereo were on;

d. descriptions of what occupied the child's time when he/she was unengaged;

e. descriptions of the movements the child displayed which occasioned engagement after a period of time in which the child was not engaged;

f. descriptions of the caretaking activities which involved the child and the nature and extent of the child's participation in those events;

g. descriptions of the activities the engagers initiated with special reference to those in which the engagers involved the children for an extended period of time;

h. descriptions of the types of engagements directed to the child when the engagers were performing household chores, and the extent to which the child was an active participant in these activities.

Receptive verbal behavior is primarily concerned with vocal engagements, and vocal engagements in combination with physical properties of the environment, which are the setting for the display

of predictable sets of movements. The establishment of this repertoire is seen as bringing the child's movements (vocal as well as non-vocal) under the control of specific vocal properties of the setting. In essence, the establishment of a receptive-acoustic verbal repertoire focuses on establishing specifiable and predictable relationships between vocal properties of the setting and subsequent movements. Thus, the second dimension of analysis was directed to the vocal controls which were addressed to the children in each of the households.

Vocal controls are defined as vocal engagements, functioning as properties of the setting, which are a statement of a contingency, e.g., "Bring me the book."; "Which is the red ball?"; "Don't play with my tea bags." We can distinguish between two types of vocal controls, that is, positive vocal controls and negative vocal controls. Positive vocal controls represent statements of a contingency which are typically expected to be followed by the display of a specific set of movements, e.g., "Get the red book, please."; "Come here." Negative vocal controls, on the other hand, typically predict the cessation of a specific set of movements, e.g., "Don't touch my crystal."; "Stop playing with my pots and pans."

Vocal controls are an especially important focal point for an initial analysis of a child's receptive verbal behavior, because the expectation for the child's behavior is implicit in the statement of the control. For example, when someone says, "Stand up" to a child, we can say that the engager expects (or wants) the child to display movements which will result in the child's upright body position with feet planted solidly on the floor.

A household in which few vocal controls are addressed to a child is an indication that the child's engagers have low expectations for him; on the other hand, a household in which many vocal controls are present indicates that engagers hold high expectations. A household in which the same or similar vocal controls are repeated multiple times highlights expectations which are too high. Vocal controls which are followed by praise or some other type of affirmation that the expected movements were displayed characterizes a situation in which an engager's expectations have been met. With exclusively acoustic data, as is the case in this study, a more ambiguous set of circumstances exists when vocal controls are not followed by affirmation of the display of the appropriate movements or an approximation to the movements. Depending on other available data, we can entertain a number of possible hypotheses about engager expectations. For example, we can say that the display of vocal controls on the part of the engagers no longer represents a true statement of their expectations. Rather the vocal controls represent high strength vocal behavior which is unrelated to the movements which the child has displayed or is displaying. Another possibility is that the engager presents the vocal control as a set of expectations but that the child's movements are the occasion for the engager to lower his expectations for the child, as is the case when the engager himself completes the specified task. Still another plausible hypothesis is that the child does display the appropriate movements, but that the engager simply does not acknowledge this in any way. Whatever the case, the set of circumstances is evidence of a breakdown in bonafide interaction between engager and child.

The third dimension of analysis, the child's vocal movements, is an important consideration in the analysis of a child's productive verbal behavior. Recall that Sapon defines productive verbal behavior as "verbally controlling behavior;" in other words, those movements (vocal and/or non-vocal) which specifiably and predictably control the behavior of other people in the environment. The establishment of this repertoire centers on bringing about specifiable and predictable relationships between movements and those engagements which follow upon the display of those movements.

In the standard verbal community, although gestures and other kinesics are considered appropriate in some settings, the nature of the controlling movements of productive repertoires are, by and large, articulatory (vocal). In fact in some situations, telephone conversations for example, articulatory movements or speech sounds alone function to specifiably and predictably control the behavior of other people. The relationship between vocal movements and the subsequent behavior of other people is central to the establishment of a productive-acoustic repertoire.

A productive repertoire is nearly equivalent to what Sapon (1973) defines as "verbal function" --"the specifiable and predictable relationship between the movements and the Subsequence." Further insight is acquired by relating this discussion to Sapon's definition of "function" - "movements which have been strengthened"(1973). If we combine these formulations, we are now in a position to define verbal function as movements which specify and predict the nature of the subsequent engagements which strengthen them. This refined

definition now permits us to specify three important characteristics of productive-acoustic repertoires which provided the basis for the analysis of the children's vocal movements in the home environments. These three characteristics are:

1. The nature of the controlling movements in the productive-acoustic repertoire is articulatory. Therefore we are interested in examining the nature of the speech sounds which the children display, and whether or not these sounds represent shapeable antecedents to articulated speech. Crying, for example, is the result of strained and very tense muscle movements of the articulatory mechanism which are usually accompanied by rapid respiration. This makes crying largely incompatible with the production of articulated speech.
2. The articulatory movements in a productive repertoire must be strengthened by engagements, that is, the voices or speech sounds produced must bring about changes in the behavior of other people in the child's environment. Thus, in this study, we are concerned with determining what types of vocal movements are followed by engagements.
3. The movements in the productive-acoustic repertoire specify and predict the nature of the subsequent engagement. Therefore, the differential function of vocal movements is worthy of our examination. We are interested in identifying those vocal movements which are followed

regularly and consistently by similar engagements, and in characterizing the nature of those engagements.

One of the words used in this study to characterize subsequent environments is the word "prominent." The special meaning it has here indicates relative magnitudes of changes in environments which follow specific movements. For example, a set of subsequent events which brings about changes in the child's acoustic, tactile, optical and gustatory environments will be considered more prominent than one which only brings about an acoustic change. Giving a child a glass of milk and saying "Oh, you wanted some milk." represents a more prominent change in the environment than the vocal movements "hi."

The fourth dimension of analysis centered around a child's non-vocal movements which were the occasion for engagements. Such an examination is important for two reasons. First, there is some evidence in the literature which indicates that certain behavioral repertoires (which this author points out are primarily non-vocal) which preclude successful language intervention or at least make such intervention difficult (Graham, 1976). Engagers are often seen as elements of the child's environment which reinforce or strengthen these repertoires. This would seem to be an especially important factor if a child's engaers pay little attention to the more desirable behaviors which the youngster displays. In addition, a non-vocal repertoire, if it exercises a fine degree of specificity of control over the social environment, may actually be construed as a system of communication. Sapon (1965), for example, views such repertoires as a type of prod[illegible] repertoire which is incompatible with the establishment

of the standard productive-acoustic repertoire.

Therefore in our analysis, we must not only look at what non-vocal movements are followed consistently by engagements and the nature of those engagements, but we are also obliged to compare these findings with those following the child's vocal movements.

RESULTS

Although the diagnostic histories, behavioral repertoires and ages of the children differed, the home environments of each had many similar properties. In each of the households, the amount of unengaged time greatly exceeded engaged time. Total unengaged time ranged from seventy to eighty-four percent of the Actual Data Time spent in the natural environment; engaged time ranged fr[illegible] sixteen to thirty percent (see Table 2).

Except for Carrie, the children's mothers were their primary engagers and their fathers were their secondary engagers. Siblings and household visitors, with the exception of Marty's grandmother, contributed little to the engagement histories of the children during the recorded period (see Table 3).

When Marty was unengaged, he spent lengthy periods playing in the water, spinning aluminum pot lids on the kitchen floor, going into the room where the tape recording apparatus was located, flapping his arms up and down, and squealing.

Clifford spent lengthy periods of time away from the mainstream of household activity playing by himself with his motorized racing car set. His parents periodically checked on him to find him playing inappropriately with his toys. When other people were present but not engaging Clifford, he moved around the house picking up objects which were about.

In contrast to Clifford and Marty, Carrie was never left alone for more than five minutes; she was always within earshot of her parents or a babysitter. As Carrie wandered about the house or sat in front

Child	Total Minutes Natural Environ.	Engaged		Unengaged	
		Time (min.)	%	Time (min.)	%
Clifford	728	219	30.0	509	70.0
Carrie	705	145	20.6	560	79.4
Marty	1345	210	15.6	1135	84.4

Table 2. Distribution of Total Time in the Natural Environment

Child	Mother		Father		Siblings		Other		Total	
	#	%	#	%	#	%	#	%	#	%
Clifford	622	79.1	136	17.4	15	1.9	13	1.6	786	100
Carrie	197	37.8	322	61.8	-	-	2	.4	521	100
Marty	793	81.1	91	9.3	1	.1	93	9.5	978	100

Table 3. Distribution and percentage of total units of engagement across engagers.

of the television, she displayed heavy breathing, alternating with periods of breath-holding or she displayed vocalizations which resembled the immediate antecedents to crying.

In all three households, when parental engagements interrupted these unengaged periods, they were likely to have followed the display of undesirable movements, and the vocal elements of many of them inferred that they were specifically occasioned by the display of undesirable movements. In the cases of Carrie and Marty, vocal and/or non-vocal undesirable movements were primarily followed by vocal engagements which were directed to their cessation, e.g., "Stop that silly breathing."; "What are you doing making those noises; stop it.", or to the display of an incompatible set of movements, e.g., "Come here."; "Now get out of there. Go sit in your seat for dessert." However, the children usually continued to display the undesirable movements, and this was often followed by repeated or additional engagements at increased loudness. When repetitions of vocal engagements failed to bring about changes in Marty's undesirable movements, he was often offered food or an activity whose consumption or engagement was predicted to bring about that change, e.g., "You wanna do to the store with me."; "Come on. I'll give you a piece of candy." In Carrie's case, after controls were repeated many times, the contingency was no longer presented and subsequent acoustic data neither confirmed nor negated inferences regarding the display of the movements. Engagements following Clifford's undesirable non-vocal movements were both vocal and non-vocal. They were usually directed to the removal of specific objects from his grasp, engagement in another activity, e.g.,

"Stay out of the refrigerator. Let's sit down at the table and play our game.", or the offer of some other object, e.g., "You can't have this one. Play with this instead."

As can be seen above, with the exception of Carrie, the undesirable movements of each of the children were frequently followed by prominent changes in their physical environments. Marty received food or was offered further activities; Cliffod was engaged for extended periods of time or was handed specific objects. As was the case with her more desirable behaviors, Carrie's undesirable movements were followed only by changes in the acoustic properties of her environment. The only re-occurring episode in Carrie's home which was consistently, and thus predictably followed by prominent environmental changes was frequent crying and/or crying-like vocalizations accompanied by eye rubbing; such episodes were followed by being put to bed.

In contrast, parental engagements acknowledged desirable movements considerably less. When desirable movements were the occasion for an engagement, the changes in the environment were rarely as prominent or as consistent as those following the display of undesirable movements. They were, for the most part, vocal engagements which ranged from praise to varying degrees of less enthusiastic affirmation.

The number of positive vocal controls exceeded the negative in each of the three cases (see Table 4). With the exception of Carrie, nearly half of all the positive vocal controls presented to a given child were followed by no detectable acoustic or inferential evidence supporting the display of the set of movements called for or a set of movements incompatible with those called for. Of the positive vocal

Child	Mother		Father		Other		Total	
	+	-	+	-	+	-	+	-
Clifford	86.2	13.8	74.6	25.4	-	-	84.2	15.8
Carrie	78.8	21.2	69.1	30.9	-	-	73.7	26.3
Marty	73.2	26.8	73.2	26.8	82.3	17.7	72.2	25.8

Table 4. Percentage distributions of positive and negative vocal controls for non-vocal movements across engagers.

controls presented to Carrie, thirty-five percent of the subsequent data fell into this category, and over half were followed by repeated or additional controls. In the other cases, repeated or additional controls followed the original statement of the control between eighteen and thirty percent of the time. Vocal affirmation, on the other hand, was considerably less frequent. It ranged from less than ten percent for Carrie and Marty to fifty percent for Clifford (see Table 5).

The distribution of data following positive vocal controls supports the conclusion that most of the contingencies for the display of a specific set of movements were not met. It would seem that most of the contingencies proposed to the four children were too high or were not accompanied by arrangements of settings which increased the probabilities of approximations to the required movements. In the case of Clifford, inferential data sometimes indicated that his parents directly manipulated his body relative to the physical environment. This and the high percentage of vocal affirmation following positive vocal controls provides evidence that 1) there were times when contingencies were probably lowered and the engager displayed the specified movements, and/or 2) positive vocal controls represented high strength vocal behavior which accompanied the direct manipulation of Clifford's body rather than the statement of a contingency.

Positive vocal controls had a higher density of occurrence during specific activities in which the engager remained for their duration. These controls were also more likely to be followed by praise than those which did not occur during a specific activity. This lends

Child	Total # of positive vocal controls	Vocal Affirmation	Acoustic Evidence supporting display	Acoustic Evidence supporting Incompatible Movements	Repeated or Addit'al Controls	No Detectable Evidence
Clifford	267	47.5	2.6	-	21.3	28.6
Carrie	207	9.2	-	-	55.5	35.3
Marty	492	6.7	6.5	9.2	28.5	49.1

Table 5. Percentage distribution of evidence for the display of appropriate movements following settings characterized by positive vocal controls.

support to the statement that contingencies were more likely to be met in such situations, and that engagers had more carefully managed and arranged the settings so as to increase the probabilities of appropriate movements. For Clifford, such activities included playing with an air car, putting colored sticks into colored blocks, playing lotto, and engaging in various caretaking tasks and household chores. For Marty, specific activities included unloading groceries and setting the table. For Carrie, the primary activities were getting ready for bed and rocking in her rocking chair. For the most part, those vocal controls which were presented during these activities did not have to compete with a high probability of undesirable behaviors, and in many cases actually represented movements which were incompatible with them. Identical and/or similar controls during these activities occurred more frequently when the activity was in itself repetitive than if the activity was frequent but temporally discrete.

All of the children displayed vocal movements. However, it was usually the inappropriate or undesirable vocal movements which functioned as properties of the setting which controlled the behavior of engagers in the most prominent ways. Marty's inappropriate and stuttered speech was followed immediately by prominent changes in his physical environment; his unintelligible vocalizations were often the occasion for his engagers to "interpret" and these were also often followed by specific environmental changes. On the other hand, Marty's most articulate and appropriate vocal movements were followed by the statement of additional vocal contingencies and/or a delay in the delivery of the change in the environment specified. Carrie's

range of inappropriate vocal movements were predictably followed by vocal engagements and occasionally by more prominent function. The only vocal movements which she displayed which were likely to represent modifiable antecedents to articulated speech were [U:], and this, displayed only in the presence of her father, never occasioned more than an echo, praise and/or a request that she do it again. Clifford's vocal movements were virtually irrelevant properties of the environment for his parents in most settings. On occasion, however, they did echo his vocalization or appropriately asked a question directed to his productive repertoire.

The children's repertoires of non-vocal movements varied considerably. Carrie moved slowly from place to place, and did not walk up or down stairs. Her mother rarely identified the non-vocal movements which she displayed. Her father, on the other hand, referred to her desirable and undesirable non-vocal movements much more frequently. He commented on her smiling and rocking in her rocker, as well as various facial expressions,and ear and nose pulling, e.g., "What a nice smile!"; "Don't give me that sad face." Clifford walked and moved freely around the house, although on occasion he stumbled when walking up or down stairs. His engagers, in addition to acknowledging when he picked up or dismantled objects, were specifically controlled by his tugging, pointing, pulling, and hitting, e.g., "Don't hit me; I'll do it."; "I know you're pointing upstairs, but not yet." Marty, in addition to displaying a full range of ambulatory movements, and walking up and down stairs, displayed a large and very refined repertoire of hand movements resulting in very fine control when

manipulating his physical environment. The non-vocal movements which most often controlled engagements were those relative to playing in water and lid spinning, e.g., "Marty, don't spin lids."; "No more playing in the sink. Now let's sit down here and eat your meal."

According to Sapon's definition, both Marty and Clifford displayed verbal behavior. Clifford displayed a non-vocal productive repertoire. His pointing, pulling, tugging and hitting specifically controlled the behavior of his engagers and resulted in prominent changes in his environment. Marty displayed both receptive-acoustic and productive-acoustic verbal repertoires. His receptive-acoustic repertoire, although by nature difficult to assess, appeared advanced. In addition to displaying non-vocal movements under the control of specific vocal properties of the setting, he displayed vocal movements under the control of specifiable vocal settings, i.e., questions were often the occasion for vocalizations, models were the occasion for echoes, and positive vocal controls directed to vocal movements often provided the setting for articulatory movements. Marty's productive-acoustic repertoire was extensive, but non-standard, since it was primarily the inappropriate, echoic and unintelligible vocalizations which were most prominently made functional by his engagers.

CONCLUSION

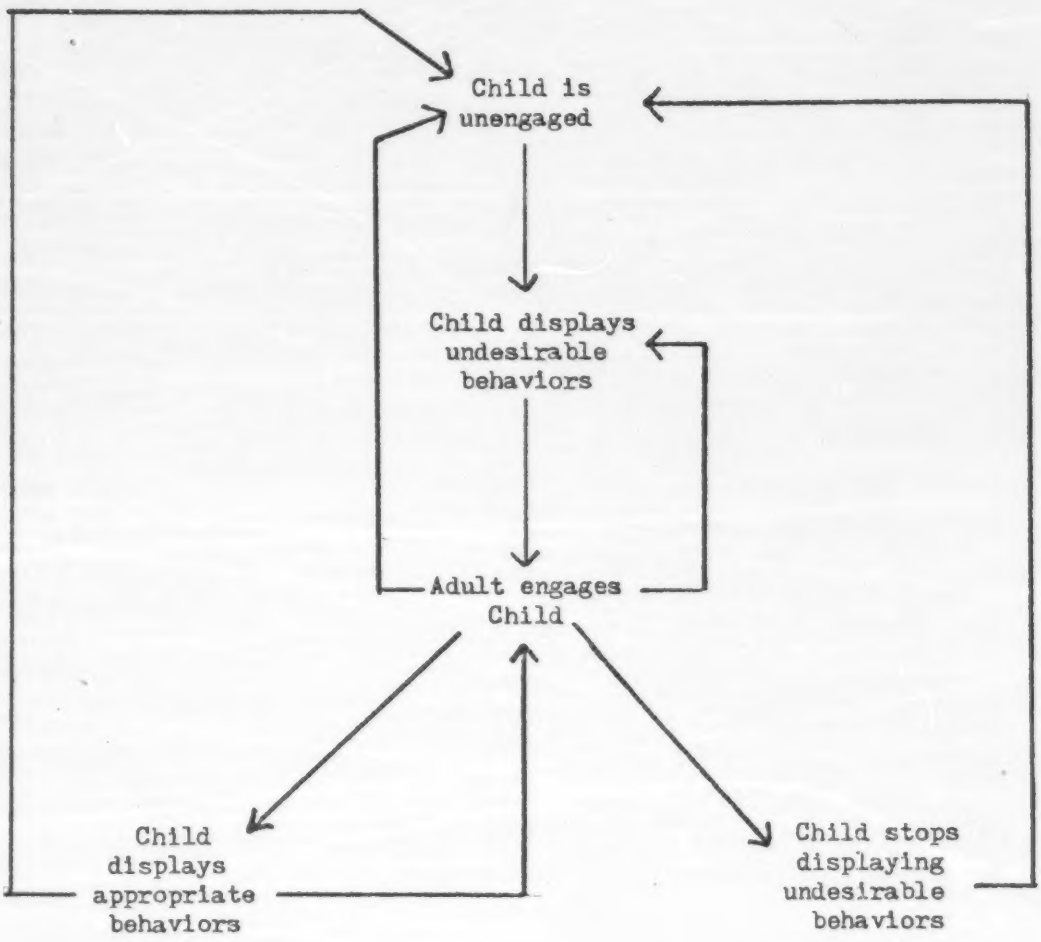
The naturalistic approach to data acquisition utilized in this study permitted the investigator to acoustically observe four days in the lives of three non-talking children. The following conclusions can be drawn from a descriptive analysis of that data:

1) Each child spent the major portion of his/her day unengaged. This seriously limited the number of opportunities for the establishment of verbal behavior. During these unengaged periods, undesirable behaviors were also likely to be displayed.

2) The nature and function of those engagements which did take place were unlikely to enhance the establishment of verbal behavior and its antecedents, and often strengthened movements which were incompatible with its establishment.

These conclusions underscore the critical necessity for parent education programs, and make clear that an effective parent education program must be directed towards the establishment of systematic teaching repertoires which relate to many facets of the child's home environment.

The most predictable relationship common to the home environments existed between unengaged periods, parental management and the display of behaviors identified by parents as undesirable. A cycle of events emerges from that data (see diagram next page). When unengaged, each of the children displayed undesirable behaviors. These undesirable behaviors were either immediately followed by engagements (as


Child is unengaged
Child displays undesirable behaviors
Adult engages Child
Child displays appropriate behaviors
Child stops displaying undesirable behaviors

was the case with Carrie and Clifford), or chains of these movements were repeatedly interrupted by engagements (as was often so with Marty). As management procedures, they generally proved ineffective, were unlikely to enhance the establishment of verbal behavior, and represented functional elements of the environment which must be viewed as contributing to the strength of those undesirable movements. In addition, when those engagements were terminated, undesirable behaviors were displayed again.

On the other hand, few engagements followed displays of movements identifiable as antecedents to verbal behavior; those that did were less prominent than engagements following undesirable movements.

The results highlight the need for language intervention programs and parent education programs which are directed to breaking this cycle of events. It would seem that parents must be taught that every natural environment setting can potentially become a special teaching setting for the establishment of verbal behavior if relevant objectives are specified within the context of daily activities such as care-taking tasks, household chores, and play. Many frequently occurring settings, if managed and arranged appropriately, can become the occasion for the establishment of new behaviors. The engager must arrange for the display of some set of movements which is appropriate to the task at hand, even if the movements represent very primitive approximations to a long range objective. If the engager holds realistic contingencies for that set of movements every time that setting appears, the movements will be established under the control of the specific setting, thus providing for the

establishment, expansion and refinement of the child's verbal behavior.

In addition, a set of objectives for establishing appropriate behaviors in unengaged settings must be pursued concommitantly, so that the unengaged periods do not remain the setting for the display of undesirable behaviors.

It is hoped that this research has opened doors to the home environments of non-talking children. Access to these environments has made it possible to set forth a broad strategy for the establishment of verbal behaviors, and has highlighted the critical need for the development of "Special Education" programs for parents of non-talking children. While these parents must make exceptional efforts in behalf of their child, it is the nature of these efforts, that is, the special manner in which they arrange and manage the home environment, which is critical.

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CLIFFORD DEMONSTRATION TAPE

SEGMENT #1
Mother: "Oh no chocolate milk. Put the chocolate back. Close the door. Here. (sounds of running water) Wanna drink of water? Wanna drink of water.

Clifford signals "no"

"No. OK. Let's go upstairs. Come with mommy. OK. Come on. Can you hold the rail by yourself. There."

SEGMENT #2
Mother: "This isn't for Clifford. You play with this one."

SEGMENT #3
Mother: "Clifford, your sister doesn't want you to have that one. Let's take this one away. This one's her rosary beads. Take this one."

SEGMENT #4
Mother to daughter: "Give this to Clifford."
Daughter: "Clifford, you don't need to be at my desk right now. You can play with this - a piece of tape. Here, why don't you just get away from my desk."

SEGMENT #5
Mother: "You want mommy to do it."

Clifford hits mother

"Don't hit me. I'll do it."

SEGMENT #6
Mother: "No, we can't go in the refrigerator. Why don't we sit at the table. Then we can watch Karen get on the bus. Wanna play our game?"
(Mother then plays lotto with Clifford)

SEGMENT #7
Father to daughter: "Just now, outside when I waved to him, he dropped his toys and he ran right up to me and pulled me in the house."

SEGMENT #8
Father: "I got you. I got you. You're not going away yet."

Clifford vocalizes several times

"No, baby we gotta do something else. Not yet, honey. You just wait a little while. I know you're pointing upstairs, but not yet."

SEGMENT #9
Father: "OK, I'll follow you. Show me where to go. (to someone else: Hummm. He wants me to get his train set.)
(Mother talking to someone in background)

"Well, what do you want? I know, I'm coming with you. Go. Yeah."

SEGMENT #10
Father: "What do you want? What do you want? Show me."

CARRIE DEMONSTRATION TAPE

SEGMENT #1

Father: "Push. Push your rocker, you lazy slug. That's a girl. That's a girl. You lazy slug. You lazy slug. That's a girl. You're like a lazy slug."

SEGMENT #2

CARRIE vocalizes

Father: Laughs. "That's a good girl." Echoes Carrie's vocalization several times. "Do that again. That was fun. [U::::] [U::::] You can make that one. Stop that silly breathing."

SEGMENT #3

Carrie "cries"

Father: Laughs. "You think if you rub those eyes long enough, daddy will put you to bed and you'll get a bottle, yeah. I'll put you to bed but without a bottle."

SEGMENT #4

Carrie "cries" several times; breathes heavily

Father: "All right. Knock it off. Knock it off."

SEGMENT #5

Carrie "cries"

Father: "Pull your arm out. Pull your arm out."

Carrie "cries"

SEGMENT #6

Father: "Bye, puggy.

Mother: "Give daddy kiss. Come on, give daddy kiss. Come on."

Father: "Kisser. Kisser." (Kisses her several times)

SEGMENT #7

Carrie vocalizes and cries very loudly.

Mother: "Do you hear her?"

Mother: "Oh, you're not very happy that daddy left. Well, that's the way.... bye, bye.....unintelligible mumbling.....

SEGMENT #8

Carrie "cries"

Mother: "Carrie. I can't help it."

Carrie "cries"

"Come HERE. Walk over to mommy. Come here. I'm right here."

"Feel better now."

"Oh, come here. Come on."

Carrie "cries"

"Oh, come on."

Carrie cries louder

"Come on. I' don't know what to do for you today, I'll tell ya.'"

CARRIE DEMONSTRATION TAPE cont'd.

SEGMENT #9

Carrie breathes rapidly, cries.

Mother: ....unintelligible comment....."Stand up. Stand up, Carrie."

↑

Carrie whines

"Oh, joy, what a pain in the neck" (walks away)

(from a distance) "Oh, Carrie, settle down. You've already had a nap this morning."

Carrie breathes rapidly

"Just settle down. That's all I have to tell ya." (Door opens and closes)

SEGMENT #10

Carrie breathing heavily

Mother: "Just drop it, Carrie. I don't wanna hear it any more."

MARTY DEMONSTRATION TAPE

SEGMENT #1

Marty spinning lids

Mother: "You may put those away, please."

Marty continues spinning lids

(walks away)

SEGMENT #2

Marty spinning lids

Mother: "Marty, don't spin lids. Marty, let's go do a puzzle."

Marty continues spinning lids

(walks in and out of room.)

Marty vocalizes and talks unintelligibly

SEGMENT #3

Marty spinning lids

Mother: "Marty, would you put the balls up on your shelf. Here, honey, would you go put these balls up on your toy shelf. Yeah, go put these up on your toy shelf, please."

Marty takes object

"Thank you, Marty."

Marty walking upstairs, then downstairs

"Thanks, Marty."

Marty begins to spin lids again.

SEGMENT #4

Marty spinning lids

Mother: "Marty, I want you to put the lids in the cupboard and you come in here and watch Sesame Street and do puzzles. Come on. We don't flap and spin lids. Put the lids away, honey.

Marty vocalizes

"Put the lids away now (with emphatic intonation)."

Marty vocalizes and continues to spin lids.

SEGMENT #5

Marty spinning lids

Mother: "Marty, stop flapping."

Marty stops momentarily, then begins again.

Marty squeals and continues to spin lids.

SEGMENT #6

Marty spinning lids

Mother: "All right, Marty, N-O."

Marty spinning lids

SEGMENT #7

Marty spinning lids

Mother: "Marty, put the lids away."

Marty continues to spin lids.

SEGMENT #8

Mother: "I don't want those spinning while I'm eating. When I'm done eating, then you can spin."

MARTY DEMONSTRATION TAPE cont'd.

SEGMENT #9

Marty: "Eh."

Mother: "Not while I'm eating. No wait until I'm done eating and then you can spin lids. When mommy's finished with her breakfast."

SEGMENT #10

Marty spinning lids.

Mother: "Marty, get out of here. I don't want you spinning those lids. Go in the living room. I don't want you spinning those lids."

Marty: "Eh."

"I am trying to light the stove. And I don't wanna hear these lids spinning. Now you go in there and watch TV or do your puzzles...."

SEGMENT #11

Grandma: "Now you just wait until grandma's through here, Marty."

(sounds of crashing lids) Marty vocalizes.

Mother: "No, no, honey. Stay down here. Don't go upstairs. Stay down here. Here, take the lids in the living room and play with them."

Marty spins lids in kitchen and then goes upstairs.

SEGMENT #12

Marty in room with tape recorder (sounds of ticking clock)

Mother: (walks in) "Oh, Marty. Come here, honey. That's the tape recorder. That's Dr. Sapon's tape recorder. Isn't it nice. But let's come out now."

Marty vocalizes unintelligibly

"Let's go play the piano. I wanna play the piano. Would you come with me and play the piano? You can push the keys down."

SEGMENT #13

Marty in room with tape recorder

Mother: "I want you to come out of there."

Marty: "eh" vocalizes softly

"I don't want you in there."

Marty vocalizes very loudly.

"Ok, you come on out now."

Marty continues to vocalize loudly

Echoes Marty's vocalization. "Come here. I wanna tell you something?"

Marty continues to vocalize

"Would you like to have a piece of candy now?"

Marty: "Piece of candy?"

"Come on. I'll give you a piece of candy. You're a good boy."

SEGMENT #14

Marty in room with tape recorder

Grandma to mother: "He's back in with your tapes."

Grandma to Marty: "Come here, Marty."

Marty vocalizes unintelligibly.

Mother: "No, don't go in there."

Marty screams loudly, vocalizes ....unintelligible at first....."Listen, I'm gonna go down to Two Guys for a little bit."

Marty: "Two guys."

"Do you wanna come with me? Put your coat on, you can come with me."

Marty vocalizes unintelligibly

(Mother never goes to store-with or without Marty)

MARTY DEMONSTRATION TAPE cont'd.

SEGMENT #15

"Out."

Marty in room with tape recorder.

Mother: "O-U-T. Out."

Marty: "Eh."

"Bring your book and come on."

Marty vocalizes

(loudly) Come on, Marty. NO! Come out."

Marty: "Come out. Come out." (talks loudly)

(interprets Marty's antecedent vocalization) "Well, let's get a cone after lunch."

Marty vocalizes

"I'll pull <u>your</u> hair. You pulled my hair. You pulled my hair."

Marty: "Pull my hair."

"<u>Don't</u> pull my hair."

Marty vocalizes, runs, cries, stamps feet.